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GUILHERME FANTINI FERREIRA

INFLUÊNCIA DE APARELHOS OCLUSAIS NA MASTIGAÇÃO DE INDIVÍDUOS COM BRUXISMO DO SONO

INFLUENCE OF OCCLUSAL APPLIANCES ON MASTICATION OF INDIVIDUALS WITH SLEEP BRUXISM

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Dissertação apresentada à Faculdade de Odontologia de Piracicaba da Universidade Estadual de Campinas como parte dos requisitos exigidos para obtenção do título de Mestre em Clínica Odontológica, na área de Prótese Dental.

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Orientadora: Professora Doutora Renata Cunha Matheus Rodrigues Garcia

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RESUMO

O bruxismo é definido como uma atividade repetitiva dos músculos mastigatórios que ocorre em duas manifestações circadianas: durante o sono (bruxismo do sono, BS) e durante a vigília (bruxismo de vigília). Sua etiologia é considerada complexa e multifatorial e sua prevalência ainda é incerta. As consequências do bruxismo impactam diretamente a qualidade de vida dos portadores, e o controle dessas tem sido amplamente estudado. Uma das terapias mais utilizadas é a inserção de aparelhos oclusais, considerada como tratamento reversível e não invasivo, utilizada principalmente para proteger a dentição. No entanto, o efeito na mastigação de indivíduos com bruxismo não está bem estabelecido. Assim, este estudo tem como objetivo apresentar uma revisão sistemática para responder à questão: "O aparelho oclusal influencia a função mastigatória de indivíduos dentados com bruxismo?". Para tanto, esta revisão foi registrada no International Prospective Register of Systematic Reviews (PROSPERO – CRD42021276758), e seguiu as diretrizes do Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). A busca na literatura incluiu seis bases de dados principais (Pubmed, Lilacs, Cochrane, Embase, Scopus e Web of Science), literatura cinza e busca manual para seleção dos artigos até dezembro de 2021. Ensaios clínicos randomizados (RCTs) e não randomizados (N-RCTs) foram incluídos comparando a função mastigatória, em termos de performance mastigatória, força máxima de mordida, força máxima de língua, atividade e volume muscular) de indivíduos dentados com BS que receberam aparelhos oclusais com aqueles que não receberam tal terapia. O risco de viés dos estudos incluídos foi avaliado com a ferramenta Cochrane de avaliação de risco de viés em estudos randomizados (ROB 2.0) e para estudos não randomizados (ROBINS-I). A certeza da evidência foi determinada pelo The Grading of Recommendations Assessment, Development and Evaluation (GRADE). Doze artigos foram incluídos nesta revisão, dentre os quais o risco de viés foi considerado baixo para quatro estudos, moderado para outros quatro, e grave para os demais estudos. A análise dos dados quantitativos foi realizada por meio da avaliação da atividade muscular e força máxima de mordida sob diferentes metodologias e períodos de avaliação. Meta-análises revelaram que aparelhos oclusais rígidos (SMD -0,199, CI -0,489 a 0,091, p = 0,178, I2 = 65%) e macios (SMD -0,148, CI -0,395 a 0,099, p = 0,241, I2 = 43%) não influenciaram a atividade muscular de indivíduos com BS. O mesmo foi observado para força máxima de mordida (aparelho oclusal rígidos: SMD -0,08, CI -1,308 a 1,147, p = 0,898, I2 = 81%; aparelho oclusal macio: SMD -16,016, CI -47,226 a 15,195, p = 0,315, I2 = 97%). No entanto, a certeza da evidência para a atividade muscular com aparelhos rígidos e para a força máxima de mordida com aparelhos rígidos e macios foi considerada muito baixa. Em

adição, a certeza da evidência foi considerada baixa para a avaliação da atividade muscular com aparelhos oclusais macios. A análise qualitativa demonstrou que os aparelhos oclusais não influenciaram a performance mastigatória e o volume muscular. No entanto, os aparelhos rígidos reduziram a força máxima da língua. Dessa forma, as análises qualitativa e quantitativa revelaram que os aparelhos oclusais não afetam a função mastigatória de pacientes com BS. Não obstante, os resultados devem ser interpretados com cautela, devido à baixa e muito baixa certeza das evidências.

Palavras-chave: Bruxismo, Placas Oclusais, Mastigação, Força de Mordida, Músculos da Mastigação.

ABSTRACT

Bruxism is defined as a repetitive activity of masticatory muscles occurring in two circadian manifestations: during sleep (sleep bruxism, SB) and another during wakefulness (awake bruxism). Its etiology is considered complex and multifactorial, and its prevalence is still quite uncertain. However, its consequences directly impact the quality of life of patients with this condition, and it is necessary to manage them correctly. Bruxism management has been widely studied, being the oral appliance insertion a reversible and non-invasive therapy mostly used to protect the dentition from its damage. However, its effect on chewing of individuals with bruxism is not well established. This systematic review aimed to answer the focused question: "Does occlusal appliance influence masticatory function of dentate individuals with bruxism?". This review was registered in the International Prospective Register of Systematic Review (PROSPERO – CRD42021276758) and followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Literature search included six main databases, literature gray, and manual search for article selection until December 2021, without language, publication time, and follow-up limitation. Randomized (RCTs) and non-randomized (N-RCTs) clinical trials were included comparing the masticatory function (through masticatory performance, maximum bite force, maximum tongue force, muscle activity and volume) of dentate individuals with SB who received occlusal appliances with those individuals who did not receive such therapy. Risk of bias was assessed with ROB 2.0 and ROBINS-I. The certainty of evidence was evaluated by using Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach. After full text reading, 12 studies were included in this review of which, the risk of bias was considered low (four), moderate (four), or serious (four). Quantitative data analysis was performed evaluating muscle activity and maximum bite force under different methodologies and evaluation times. Meta-analyses revealed that occlusal appliances did not influence muscle activity with hard (SMD -0.199, CI -0.489 to 0.091, p=0.178, I^2=65%) and soft occlusal appliances (SMD -0.148, CI -0.395 to 0.099, p=0.241, I^2=43%) and maximum bite force with hard (SMD -0.08, CI -1.308 to 1.147, p=0.898, I^2=81%) and soft occlusal appliances (SMD -16.016, CI -47.226 to 15.195, p=0.315, I^2=97%) of individuals with SB. Nonetheless, the certainty of evidence was considered very low for muscle activity with hard appliances and maximum bite force with hard and soft occlusal appliances. On the other hand, the certainty of evidence was considered low for the assessment of muscle activity with soft occlusal appliances. The qualitative analysis shows that occlusal appliances did not influence masticatory performance and muscle volume. However, hard occlusal appliances seem to

reduce maximum tongue force. Therefore, the qualitative and quantitative analysis revealed that occlusal appliances do not affect masticatory function. However, the results must be interpreted carefully, due to the low and very low certainty of evidence.

Keywords: Bruxism, Occlusal Splints, Mastication, Bite Force, Masticatory Muscles

SUMÁRIO

1 INTRODUÇÃO

O bruxismo é definido como uma atividade repetitiva dos músculos mastigatórios, com duas manifestações circadianas distintas, sendo uma delas durante o sono (bruxismo do sono, BS) e outra durante a vigília (bruxismo de vigília) (Lobbezoo et al., 2013). Além disso, sabe-se que o bruxismo é caracterizado tanto por condições que envolvem os dentes, como seu apertar ou ranger, quanto por condições que não os envolvem, como a contração da musculatura ou protrusão mandibular (Lobbezoo et al., 2018). O bruxismo de vigília é definido como uma atividade repetitiva dos músculos mastigatórios durante a vigília (Lobbezoo et al., 2018), caracterizado pelo ranger e/ou apertar os dentes enquanto o indivíduo está acordado (Goldstein et al., 2017), e normalmente ocorre sem ruídos (Badder et al., 2000). Por outro lado, de acordo com a Terceira Edição da Classificação Internacional das Desordens do Sono (ICSD-3), o BS é um distúrbio de movimento relacionado ao sono, definido como uma atividade muscular rítmica ou não-rítmica da mandíbula que resulta no ranger e/ou apertar dos dentes durante o sono, podendo inclusive ocasionar o despertar (Thorpy, 2017). O BS é acompanhado de ruídos em cerca de um terço dos indivíduos acometidos (Lavigne et al., 2001).

A etiologia do BS é um assunto muito discutido na literatura, sendo considerada complexa e multifatorial (Beddis et al., 2018). Atualmente, a hipótese etiológica mais aceita é de que essa desordem é decorrente da ativação do sistema nervoso central durante o sono (Carra et al., 2012; Fernandes et al., 2013) em detrimento de outras que apoiam fatores periféricos, como as interferências oclusais, como sendo predominantes na sua etiologia (Lavigne et al., 2009). Acredita-se que o sistema nervoso autônomo, cujos centros de ativação se localizam principalmente no tronco cefálico, medula espinhal e hipotálamo, é ativado e potencializado por possíveis excitações que ocorram durante o sono, que resultam em movimentos rítmicos motores, sem função de trituração de alimentos, e caraterizado pela contração conjunta dos músculos elevadores e abaixadores da mandíbula (Carra et al., 2012).

Além da ativação do sistema nervoso central, existem fatores de risco que podem contribuir para o BS (Carra et al., 2012) como: *(1)* fatores exógenos, como tabagismo, ingestão excessiva de álcool, cafeína, medicamentos ou drogas ilícitas (Ohayon et al., 2001), *(2)* fatores psicossociais, como ansiedade e estresse (Lavigne et al., 2008) e *(3)* distúrbios do sono, envolvendo despertares (Beddis et al., 2018). Tendo em vista esses fatores de risco, o BS pode ser considerado como primário quando não existe nenhum fator médico associado,

ou secundário quando há presença de fatores psiquiátricos ou outras condições médicas associadas (Needhan et al., 2013).

A prevalência do BS é incerta devido à variedade de metodologias utilizadas para sua identificação, bem como diferentes níveis de confiabilidade para a coleta dos dados (Beddis et al., 2018). O BS acomete entre 8 e 13% da população geral (Lavigne et al., 2008; Manfredini et al., 2013). Ao considerar a distribuição do BS por faixa etária da população, este acomete cerca de 7,4% da população adulta (Maluly et al., 2013) e possui a tendência de reduzir com o envelhecimento, sendo acometido cerca de 3% da população idosa acima dos 65 anos (Manfredini et al., 2013). Sendo assim, para se compreender de fato a prevalência do BS na população, o método de diagnóstico utilizado é fundamental.

O diagnóstico do BS pode ser feito por meio do relato do paciente associado a anamnese (van der Meullen et al., 2006), exame clínico, histórico de uso de aparelhos intraorais, análise da atividade muscular e polissonografia (Beddis et al., 2018). No entanto, segundo o Consenso Internacional de definição de Bruxismo em 2013 (Lobbezoo et al., 2013), a utilização isolada do relato do paciente somente provê um "possível diagnóstico" de BS. Contudo, quando associado ao exame clínico torna-se "provável", e somente será considerado "definitivo" se for associado ao exame de polissonografia (Lobbezoo et al., 2013; Paesani et al., 2013). A polissonografia é referência para o diagnóstico do BS (Paesani et al., 2013), mas devido à sua complexidade e alto custo torna-se inviável durante a rotina clínica (Manfredini et al., 2013; Paesani et al., 2013). Portanto, o exame polissonográfico é limitado às pesquisas clínicas que necessitam do diagnóstico "definitivo" do BS e pacientes que apresentam comorbidades associadas (Beddis et al., 2018).

Como consequências do BS, podem ocorrer hipertrofia dos músculos mastigatórios, perda ou desgaste de superfície dental, fratura de restaurações e/ou do próprio dente, e até hipersensibilidade dental (Paesani et al., 2010; Lobbezoo et al., 2012; Fernandes et al., 2013; Lobbezoo et al., 2017). Além disso, tal desordem pode causar complicações mecânicas em pacientes reabilitados com implantes dentários, podendo ocorrer a fratura do implante ou da própria prótese (Lobbezoo et al., 2017). No entanto, mesmo apresentando BS, alguns portadores podem ser considerados saudáveis, uma vez que não manifestem nenhuma das consequências acima citadas (Lobbezoo et al., 2018). Diante disso, o BS em si não requer tratamento, exceto quando causam os problemas mencionados anteriormente (Beddis et al., 2018).

As modalidades terapêuticas atuais para o BS limitam e previnem os danos físicos resultantes do ranger dos dentes (Harada et al., 2006), incluindo o aparelho oclusal,

biofeedback, higiene do sono e terapia miofuncional (Lobbezzo et al., 2008). Dentre essas técnicas, o aparelho oclusal é a terapia mais bem estabelecida para gerenciar as consequências do BS de forma reversível e não invasiva (Lobbezzo et al., 2008; Singh et al., 2015), protegendo dentes e/ou estaurações contra desgastes e fraturas (Mainieri et al., 2008).

O mecanismo de ação do aparelho oclusal ainda não está totalmente esclarecido (Carra et al., 2012). Ash e colaboradores (1995) desenvolveram a teoria da alteração da oclusão, ou seja, o uso dos aparelhos oclusais garantiriam um esquema oclusal ideal e, portanto, toda a atividade muscular excessiva causada por interferências oclusais seria reduzida ou eliminada (Ash et al., 1995). Outra teoria proposta é a de que os aparelhos oclusais aumentam a dimensão vertical de oclusão por meio da desoclusão dos dentes, e como consequência ocorre o relaxamento muscular e reposicionamento mandibular, com redução da pressão interarticular nas articulações temporomandibulares (ATM) (Okeson, 2007). No entanto, a oclusão não é considerada fator etiológico do BS (Ribeiro-Lages et al., 2020). Além disso, não existe consenso na literatura sobre o efeito de relaxamento muscular através do uso dos aparelhos oclusais. Alguns autores (Hamada et al., 1982; Roark et al., 2003; Akat et al., 2020) sugerem que o uso desses aparelhos reduz a atividade dos músculos mastigatórios, enquanto outros (Dalewski et al., 2014; Gomes et al., 2014) não encontraram diferença na atividade muscular entre os usuários e não usuários de aparelhos oclusais rígidos e até aumento da atividade entre usuários de aparelhos oclusais macios (Okeson, 1987). Por sua vez, Ekberg e colaboradores (1998) propuseram a teoria do reposicionamento da ATM (Ekberg et al., 1998). Nesta última teoria, os aparelhos oclusais reposicionariam o côndilo para uma posição musculoesquelética mais estável e funcionalmente mais compatível (Ekberg et al., 1998), com consequente redução de estresse sobre as ATMs (Santos Júnior et al., 1988). Não obstante, Silva e colaboradores (2020) demonstraram, por meio de análise de elementos finitos, que a distribuição e intensidade do estresse resultante da transmissão de forças mastigatórias de pacientes tratados com aparelhos oclusais sobre as ATMs não foram alteradas (Silva et al., 2020), sendo que a tensão se concentrou na região anterior do disco articular (Silva et al., 2020). A teoria do efeito cognitivo determina que uma vez posicionados, os aparelhos constantemente alertam o paciente sobre o apertar e ranger dos dentes levando a alteração de seu comportamento habitual e consequentemente diminuição da atividade muscular anormal (Clark et al., 1984), evidenciado por resultados clínicos semelhantes entre aparelhos oclusais rígidos e macios (Turp et al., 2004). No entanto, o uso dos aparelhos oclusais macios não é indicado para tratamento do BS, visto que as alterações causadas pelo BS podem ser potencializadas (Okenson., 1987). Por fim, a teoria do efeito placebo (Forssel et al., 2004) diz

que os efeitos da terapia não estão ligados ao aparelho oclusal em si, mas sim em comportamentos orais resultantes da utilização de qualquer tipo de dispositivo (Forssel et al., 2004), uma vez que a efetividade clínica no alívio da dor é semelhante a métodos gerais de tratamento da dor, portanto essa efetividade foi atribuída ao efeito placebo (Forssel et al., 2004).

Os aparelhos oclusais podem ser classificados conforme o tipo de material utilizado na sua fabricação, podendo ser aparelhos macios, semi-macios ou rígidos. Os aparelhos oclusais macios, confeccionados em acrílico resiliente ou silicone, são considerados de fácil fabricação e adaptação pelo paciente (Klasser et al., 2009). Entretanto, estes dificultam os ajustes, deterioram-se rapidamente e podem até mesmo exacerbar os sintomas do BS, não sendo indicado para o tratamento de bruxismo do sono (Gray et al., 2003). Os aparelhos "semi-macios" apresentam uma camada de acrílico resiliente ou silicone adaptado aos dentes e recoberta por outra camada de resina acrílica (química ou termicamente ativada) na superfície interoclusal, os quais teoricamente, oferecem os benefícios dos aparelhos rígidos e macios, ou seja, a melhor adaptação e conforto ao paciente dado pelo material macio e uma superfície mais fácil de ser ajustada pelo material acrílico rígido (Harkins et al., 1988; Akat et al., 2020). Por sua vez, os aparelhos oclusais rígidos são confeccionados com resina acrílica química ou termicamente ativada, e são efetivos na prevenção do desgaste dental e/ou de materiais restauradores (Alkan et al., 2008). Tais aparelhos mostram-se mais efetivos no controle das consequências do bruxismo do sono, tornando-os assim a principal escolha terapêutica (Harada et al., 2006).

Além da classificação segundo o tipo de material de confecção, os aparelhos oclusais podem ser categorizados de acordo com a extensão da cobertura oclusal, podendo ser identificados como aparelho de cobertura oclusal total ou parcial. Segundo alguns autores (Beddis et al., 2018), os aparelhos de cobertura oclusal total são eficazes na redução e eliminação de desgastes dentários, ruídos e dor miofascial, garantindo contatos equilibrados ao longo de toda arcada dental, mantendo orientação dos caninos durante as excursões mandibulares (Beddis et al., 2018). Por sua vez, existem os aparelhos de cobertura parcial anterior, como a placa de inibição trigeminal nociceptiva (Beddis et al., 2018). O mecanismo de ação desses aparelhos ocorre por meio da desoclusão dos dentes posteriores com consequente redução da força máxima de aperto e desta forma previne as consequências deletérias resultantes do apertar e ranger dos dentes (Beddis et al., 2018). O uso dos aparelhos parciais deve ser monitorado cuidadosamente devido ao risco de mobilidade dentária ou

erupção excessiva de dentes descobertos, bem como alterações oclusais resultantes do uso prolongado (Stapelmann et al., 2008; Conti et al., 2012).

Embora os aparelhos oclusais sejam o tratamento mais comum para o BS (Lobbezzo et al., 2008), apresentando efeitos benéficos para preservação da estrutura dental e/ou protética (Beddis et al., 2018), pouco se sabe sobre a sua influência na função mastigatória. A mastigação é um mecanismo complexo (De Marchi et al., 2008) que requer a ativação muscular adequada para realizar os movimentos mandibulares e exercer força com intuito de cortar e triturar os alimentos (van der Bilt et al., 2006). Desta forma, o controle neuromuscular é essencial para permitir uma ação coordenada entre os músculos mastigatórios e as demais estruturas do sistema estomatognático (van der Bilt et al., 2006). No entanto, bruxistas do sono sintomáticos apresentam aumento da atividade eletromiográfica dos músculos mastigatórios, em especial dos masseteres e temporais, afetando negativamente a eficiência mastigatória (Palinkas et al., 2019).

Inúmeros trabalhos científicos (Harada et al., 2006; Lobbezzo et al., 2008; Singh et al., 2015; Mainieri et al., 2008; Mainieri et al., 2014; Roark et al., 2003; Hamada et al., 1982) constataram os benefícios do uso dos aparelhos oclusais como terapia para o BS, porém não existem revisões sistemáticas sobre sua influência na função mastigatória. Tendo em vista que terapias que diminuem os efeitos deletérios do BS sobre o sistema estomatognático continuam sendo um desafio na Odontologia, este trabalho o objetivo do autor foi obter evidências sólidas e elucidar se o controle das consequências do BS por meio da inserção de aparelhos oclusais influencia a função mastigatória de indivíduos dentados. Para isto, foi realizada uma revisão sistemática da literatura com meta-análise, sendo a questão central a ser respondida: “O aparelho oclusal influencia a função mastigatória de indivíduos dentados com Bruxismo do Sono?”.

2 ARTIGO: Influence of occlusal appliances on chewing of individuals with sleep bruxism: A systematic review and meta-analyses

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Abstract

Objective: This systematic review aimed to answer the focused question: “Does occlusal appliance influence masticatory function of dentate individuals with sleep bruxism?”.

Methods: This review was registered in the International Prospective Register of Systematic Review (PROSPERO - CRD42021276758) and followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Literature search included six main databases (Pubmed, Lilacs, Cochrane, Scopus, Embase and Web of Science), gray literature, and manual search for article selection until December 2021, without language, publication time, and follow-up limitation. Randomized (RCTs) and non-randomized (N-RCTs) clinical trials were included comparing the masticatory function of dentate individuals with sleep bruxism who received occlusal appliances with those individuals who did not receive such therapy. Risk of bias was assessed with risk of bias assessment for randomized clinical trials tool (RoB 2.0) and risk of bias assessment for non-randomized clinical trials (ROBINS-I), for RCT and N-RCT, respectively.

Results: After full text reading, 12 studies were included in this review of which, the risk of bias was considered low (four), moderate (four), or serious (four). Quantitative data analysis revealed that occlusal appliances did not influence muscle activity with hard (SMD -0.199, CI -0.489 to 0.091, p=0.178, I^2=65%) and soft occlusal appliances (SMD -0.148, CI -0.395 to 0.099, p=0.241, I^2=43%) and maximum bite force with hard (SMD -0.08, CI -1.308 to 1.147, p=0.898, I^2=81%) and soft occlusal appliances (SMD -16.016, CI -47.226 to 15.195, p=0.315, I^2=97%) of individuals with SB. Qualitative analysis showed also that occlusal appliance did not influence masticatory performance and muscle volume. However, it was effective in reducing maximum tongue force. The certainty of evidence was considered very low for muscle activity with hard appliances and maximum bite force with hard and soft occlusal

appliances. On the other hand, the certainty of evidence was considered low for the assessment of muscle activity with soft occlusal appliances.

Conclusion: Occlusal appliances did not influence masticatory function of dentate individuals with sleep bruxism. Notwithstanding the results must be interpreted with caution, due to the low and very low certainty of evidence.

Keyword: Bruxism, occlusal splint, mastication, bite force, masticatory muscle.

Introduction

Bruxism is characterized by repetitive muscle activity presenting two distinct circadian manifestations: awake bruxism and sleep bruxism (SB).[1] SB is a behavioral/physiological manifestation which results from rhythmic and non-rhythmic activity of masticatory muscles,[1] and may lead to masticatory muscle hypertrophy, tooth wear, and/or fracture of restorations or teeth due to excessive occlusal force.[2] Moreover, these signs of SB may or may not be associated with myofascial pain.[3] Therefore, when these signs are present, they must be controlled. It is also possible that SB can manifest without any harm [1] and not require treatment [4].

Therapeutic modalities are available for treatment of SB which limit and prevent physical damage from teeth grinding.[5] These therapies include occlusal appliance insertion, biofeedback, sleep hygiene, and myofunctional therapy.[6] Among these techniques, use of an occlusal appliance is the best-established therapy for managing consequences of SB in a reversible and non-invasive way.[7, 8] It protects teeth and could promote a transient muscle relaxation [5] and force redistribution. [8] However, to date, the mechanism of action of occlusal appliances remains undefined. [9] One of the hypotheses is associated with the placebo effect of such devices, since no difference was observed in the effectiveness between the use of occlusal appliances and palatal devices.[10, 11] Another assumption is that they increase the

occlusal vertical dimension and eliminate occlusal interferences, thereby reducing overload of the temporomandibular joint structures and increasing peripheral entry to the central nervous system.[12]

Evidence regarding the effects of occlusal appliances on muscle function remains contradictory. For example, some authors[13, 14, 15] have suggested that use of occlusal appliances reduces the activity of masticatory muscles, while other authors[16, 17, 18] have reported no difference in muscle activity between users and non-users of occlusal appliances. Meanwhile, Ernst et al.[19] observed an increase in masticatory muscle activity after treatment with soft occlusal appliances. Thus, while occlusal appliances are the most common treatment for SB [8, 9] and they preserve dental and/or prosthetic structure,[8] their effects on masticatory muscles and other structures of the stomatognathic system remain unclear. Chewing involves a complex mechanism that requires both accurate neuromuscular control to generate adequate activation of masticatory muscles, and promotion of mandibular kinematics and bite force sufficient to crush and grind various food textures.[20] Since changes in muscle activity following occlusal appliance insertion are still a controversial issue, it is unknown if they can also influence masticatory function. Therefore, the aim of this systematic review was to elucidate whether treatment of SB by occlusal appliance insertion influences masticatory function in terms of masticatory performance (MP), maximum bite force (MBF), maximum tongue force (MTF), muscle activity (MA), and muscle volume.

Materials and Methods

This systematic review is registered in the International Prospective Register of Systematic Reviews (PROSPERO; no. CRD42021276758) and complies with the Preferred Reporting Items for Systematic Reviews (PRISMA) statement and checklist.[21]

Eligibility criteria

Studies were selected according to the PICO strategy with subjects with SB (P) divided into two groups. One group received occlusal appliances for treatment (I), while a second group did not receive an occlusal appliance or were delayed in receiving an appliance (C). Masticatory function was evaluated for both groups, specifically regarding MP, MBF, MTF, MA, and muscle volume (O). Eligible articles included studies on dentate patients diagnosed with SB who received any type of occlusal appliance regardless of manufacturing material and occlusal coverage extension, as a way of controlling the consequences of this disorder. There was no limitation on the different methods used or the evaluation time of outcomes.

Randomized clinical trials (RCTs) and before and after non-randomized clinical trials (N-RCTs) were included which compared dentate patients who received or did not receive occlusal appliances to manage SB. Non-controlled clinical trials, case series, case reports, reviews, conference abstracts, experts' opinions, and studies presenting incomplete data were excluded.

Information sources and search strategy

Studies included in this review were identified from MEDLINE databases, including: PubMed, Cochrane Library, Embase, Latin American and Caribbean Health Sciences Literature database (LILACS) via Virtual Health Library, Scopus, and Web of Science. Gray literature was also explored via Google Scholar, Brazilian Clinical Trials Registry (REBEC), Clinical Trials database, and Open Grey. Furthermore, references of included studies were manually evaluated to identify possible studies, according to the recommendation of Greenhalgh and Peacock (2005). There were no limitations on language, time of publication, or follow-up period for the literature searches.

Our search strategy was established according to each database and was guided by an expert librarian (Table 1). Identified articles were exported to an online reference

management software (Rayyan; Qatar Computing Research Institute) and duplicates were only considered once.

Study selection was independently performed in a two-phase process (titles/abstracts, then full text readings). The first phase consisted of reading titles and abstracts of records screened by two independent and trained reviewers (G.F.F. and T.M.C.). An online software program (Rayyan; Qatar Computing Research Institute) was used to identify studies as "included", "excluded", or "maybe". When disagreements arose between the examiners, a third reviewer (R.C.M.R.G.) was contacted to propose a consensus. When titles/abstracts did not provide sufficient information, or when an abstract was not available, articles were downloaded, and their full text was analyzed to determine their eligibility. The second phase involved reading the full text of articles and this was performed by the same two reviewers. When disagreements arose, the third reviewer (R.C.M.R.G.) proposed a consensus.

The following details were extracted using customized extraction forms: *(a)* author(s), year of publication, and country; *(b)* study design; *(c)* sample size and subjects' characteristics, such as age and gender; *(d)* types of occlusal appliances used; *(e)* masticatory function tests performed to evaluate MP, MBF, MTF, MA, and muscle volume; *(f)* results, with a focus on data which determined whether occlusal appliance insertion influenced masticatory function; *(g)* main conclusions. To recover missing data, up to three attempts were made weekly to contact the corresponding authors.

Risk of bias in individual studies

Two independent examiners (G.F.F. and T.M.C.) carried out evaluations of the methodological quality of the included studies by using different critical appraisal tools, according to the type of study. RCTs were analyzed with the Cochrane Risk of Bias Tool for RCT (RoB 2.0)[22] and N-RCTs were analyzed with the Cochrane Risk of Bias in Nonrandomized Studies of Interventions for before and after studies (ROBINS-I).[23]

If clarification was needed regarding study data, authors were contacted weekly, up to five times by email, in an effort to improve the accuracy of qualitative synthesis. After performing quality assessments, and in cases of divergence, a third researcher (R.C.M.R.G) proposed a consensus for the analysis.

Quantitative analysis

Data were analyzed by using Comprehensive meta-analysis software (version V3, Biostat, Inc., Englewood, NJ, USA) to evaluate the influence of occlusal appliances on MBF and MA. Comparisons were made of data obtained before, and 30 days after, use of occlusal appliances in all the analyses performed.

Mean and standard deviation values for MBF and MA (before and after occlusal appliance use) were considered. An interpatient correlation coefficient of 0.5 was assumed.[24] Separate analyses were performed according to the type of occlusal appliance used (hard or soft) and the subgroup of muscle evaluated (temporal or masseter muscles) in the MA analyses. Pooled effect size was calculated by standard mean difference (SMD), since the studies assessed the same outcome, yet measured with different forms of assessment. Heterogeneity of effect size was assessed by applying the I^2 test, and a random effect model was applied.

Certainty of evidence

Certainty of evidence was determined for the outcomes evaluated in our meta-analysis by using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach. Briefly, clinical trials studies have their risk of bias evaluated through RoB-2 and ROBINS-I and start with high evidence. Certainty of evidence decreases to moderate, low, or very low quality if serious, or very serious, issues related to risk of bias, inconsistency, indirectness, imprecision, or publication bias are present. Sensitive analyses

were performed to evaluate the significance of the influence of risk of bias in effect. Presence of TMD was considered for indirectness.

Quality of evidence can also be upgraded if the magnitude of an effect is large, or very large, or if the effect of all plausible confounding factors would reduce the effect or suggest a spurious effect. In this manner, quality of evidence can vary from very low to high. A summary of quantitative and qualitative outcome findings for the present study are presented in Table 7 which was produced with GRADE online software (GRADEpro GTD, Copenhagen, Denmark).

Results

Study selection

Figure 1 shows the PRISMA flow diagram of the studies selected. An initial search of six literature databases identified a total of 1205 articles. After removing duplicates and reading titles/abstracts, 17 studies from the main databases and one from gray literature were selected for full-text reading. Five articles did not meet the eligibility criteria and were excluded (Table 2). Briefly, five studies were excluded, four of them because the selected volunteers presented only TMD, and another because bite force of the participants was evaluated during polysomnography exams. Therefore, a total of 12 studies were determined to be suitable for data extraction and qualitative synthesis. [2, 8, 13, 14, 15, 16, 17, 25, 26, 27, 28, 29] Six studies were included for quantitative analysis. [2, 8, 15, 16, 26, 27]

Risk of bias in studies

Table 4 and Figure 2 present classification of the selected studies according to the RoB 2.0 Cochrane tool. Three RCTs were classified as having low risk of bias, [15, 16, 17] with all domains assessed as low risk. All these studies presented acceptable forms of randomization, an intervention was adequately assigned, no data were missing, and adequate methods for evaluating results were employed.

Nine N-RCTs were assessed according to ROBINS-I for before and after studies (Table 5, Figure 3). Only one study was classified as having low risk of bias.[12] Four articles were classified with moderate risk of bias,[2, 8, 26, 27] while another four studies were classified with serious risk of bias.[13, 25, 26, 29] Four N-RCTs[8, 15, 26, 28] did not indicate relevant confounding factors (presence of TMD, masticatory muscle pain, use of medications, previous treatment with an occlusal appliance, dental absence and use of prosthesis, malocclusion, orthognathic surgery, and different facial pattern) related to bruxism treatment with occlusal appliances. Participants' data were also missing. The articles classified as serious risk of bias[13, 25, 26, 29] did not report results of all of the participants due to lack of adherence to the proposed intervention. In addition, compromised sample calculation and insufficient information was provided to the patients regarding use of an occlusal appliance.

The N-RCT study[12] classified as low risk of bias was because it did not presented confounding factors for the participants selected, and participants who did not adhere to the intervention were excluded from the study. The evaluators also instructed the patients to follow their treatment plan with occlusal appliances as closely as possible.

Finally, five authors were contacted to clarify the methodologies used. Specifically, whether different evaluators performed tests and/or prepared the occlusal appliances. Three authors[14, 25, 29] answered within five contact attempts. One study[25] had a single evaluator, while two of the studies[14, 29] had a third evaluator, and this decreased the risk of the evaluator's influence on the results due to their knowledge of the intervention.

Study characteristics

Characteristics of the studies selected for this study are summarized in Table 3. The selected studies were published between 1982 and 2020, and were conducted in Brazil,[8, 16, 25, 26, 27, 29] Turkey, [2, 15, 28] United States of America,[12] Japan,[11] and Poland.[15] Three studies were RCTs[15, 16, 17] and nine were N-RCTs.[2, 8, 13, 14, 25, 26, 27, 28, 29] A total of 382 participants were

evaluated (mean age: 28.17 y; range: 18–66). Three different types of occlusal devices were analyzed according to the material used for their manufacture, namely: hard,[2, 13, 14, 15, 16, 17, 25, 27, 28, 29] soft,[8, 15,16, 26] and semi-soft.[13] The outcomes evaluated to assess masticatory function included: MP,[25] MBF,[2, 8, 26, 27] MTF,[29] MA,[13, 14, 15, 16, 17] and muscle volume[15, 28] (Table 6).

MP was evaluated by optical scanning method count and the image analysis software system, Image-Pro Plus 1.4 (Media Cybernetics).[25] MBF was verified using a digital gnathodynamometer (model DDK, Kratos Equipamentos Industriais Ltda., Cotia, SP, Brazil),[27] a pressure-sensitive sheet (Dental Prescale, 50 H, type R, 97 μm thick), apparatus (Occluzer),[2] and cross-arch force transducer (Sensotec 13/2445-02, Columbus, OH, USA).[8, 26] Values are expressed in Newtons (N). MTF was determined by using a bite force transducer (Standard FSR 400; Interlink Electronics),[29] with values expressed in N. MA was determined from electromyographic records[13] using a BioEMG 4/8 Channel Electromyograph device (BioPak, BioResearch Inc.) with surface BIOTRODE No-Gel bipolar electromyographic electrodes,[15] a four-channel EMG Bluetooth measuring system (Zebris Medical GmbH) [18], an eight-channel module (EMG System do Brasil Ltd.),[16] and electrodes connected to EMG Modules (M-501).[14] Values were expressed in μV/ms[16] and μV/s.[13, 14, 16, 17] Muscle volume was assessed from magnetic resonance (1.5 Tesla, Siemens, Magnetom Avanto)[28] and ultrasonography (Hitachi)[15] images. Values are expressed in cubic centimeters (cm^3) and millimeters (mm), respectively.

Results of individual studies

MP

One study[25] evaluated MP and no influence from occlusal appliances was observed at various evaluation periods (7, 15, 30, and 60 days after treatment) ($P > 0.05$). The number of masticatory cycles also did not influence masticatory performance among users of occlusal

appliances ($P > 0.05$) at different evaluation times. Certainty of evidence for MP was very low (Table 8).

MBF

Three studies showed reduction of MBF after several different periods (before and after one month or before and after three months) of soft appliances use ($P = 0.018$,[2] $P = 0.018$,[8] and < 0.001,[26] respectively). In addition, one study[27] demonstrated that one and two months after insertion of a hard device, participants exhibited increased MBF on the left ($P = 0.0122$) and right ($P = 0.003$) sides.

MTF

To evaluate MTF on the anterior and posterior regions, one study[29] used sensors fixed in a mandibular intraoral device. Participants were instructed to occlude and press the tongue as hard as possible against the lingual surface of the teeth. Evaluations were conducted before and after one and two months of hard device therapy. MTF at the anterior region decreased after one month (< 0.001). At the posterior region, MTF of all the participants decreased only after 2 months ($P = 0.002$) of occlusal appliance device use.[29] The certainty of evidence for MTF was very low (Table 8).

MA and muscle volume

Three studies[13, 14, 17] used hard occlusal appliances for SB therapy. One of these studies[14] demonstrated a reduction on electromyographic MA for the left and right temporal at maximum clenching (< 0.001), and for the right temporal and left masseter under moderate clenching (< 0.05) after hard device use. Similarly, another study[13] observed reduced electromyographic MA for the preferred and non-preferred chewing sides of the masseter (P = 0.04 and P = 0.04, respectively) and temporal (P = 0.02 and P = 0.02, respectively) muscles. On the other hand, another study[17] did not show an influence on the anterior right and left temporal (P = 0.78 and P = 0.82, respectively) and right and left masseter (P = 0.91 and P =

0.11, respectively) muscles after one month of treatment with a hard occlusal appliance and nociceptive trigeminal inhibition devices.

Comparisons were also made of hard, soft, and semi-soft appliances[15] with or without accompanying massage therapy for SB treatment.[16] The three different materials that composed the occlusal appliances used did reduce electromyographic activity; however, after one month of treatment, the hard devices achieved better reduction of MA (< 0.05).[15] In contrast, there were no differences observed between the different types of appliances and temporal MA (> 0.05).[15, 16] In addition, the association of hard appliances and massage did not reduce right and left masseter (P = 0.91 and P = 0.15, respectively) or right and left temporal (P = 0.44 and P = 0.60, respectively) MA after one month; yet decreased intensity of signs and symptoms among individuals with severe TMD and SB (P < 0.001).[16]

Two studies evaluated muscle volume from magnetic resonance images[28] and ultrasonography.[15] In the former, masseter muscle volume was evaluated before and after use of a hard occlusal appliance for four months, and no changes in right and left masseter muscle volume were observed between genders (P = 0.530 and P = 0.721, respectively). In the other study,[15] the length and thickness of the temporal and masseter muscles exhibited no difference between use of hard, soft, or semi-soft occlusal appliances (P > 0.05). Certainty of evidence for MV was also very low (Table 8).

Results of quantitative synthesis

Six of the twelve included studies were not included in the quantitative analysis due to data variability.[13, 14, 15, 25, 28, 29] For example, several parameters of masticatory function (MP, MBF, MTF, MA, and muscle volume) were evaluated with different methodologies and evaluation periods.

Based on the inclusion criteria established for the present study, only one retrieved study[25] assessed MP, and one[29] MTF. Thus, meta-analyses could not be conducted for either.

In addition, muscle volume was evaluated by magnetic resonance[28] and ultrasonography,[15] which prevented a statistical analysis of these data. However, meta-analyses were able to be performed for MA[15, 16] and MBF.[2, 8, 26, 27]

Meta-analysis of MA

Two studies[15, 16] were included in the meta-analysis of MA (Figures 4 and 5). No significant difference was found in MA of the left and right masseter muscles (SMD: -0.354, CI: -1.407 to 0.698, p = 0.509, I^2 = 87% and SMD: -0.345, CI: -1.416 to 0.725, p = 0.527, I^2 = 87%, respectively), or in the left and right temporal muscles (SMD: -0.238, CI: -0.634 to 0.159, p = 0.24, I^2 = 20% and SMD: -0.063, CI: -0.577 to 0.450, p = 0.809, I^2 = 52%, respectively), with use of hard occlusal appliances. There was also no difference observed overall for the analysis that included hard occlusal appliances (SMD: -0.199, CI: -0.489 to 0.091, p = 0.178, I^2 = 65%) (Figure 4). The certainty of evidence was considered very low (Table 7).

Similarly, no significant difference was observed in MA of the left and right masseter muscles (SMD: -0.073, CI: -0.537 to 0.390, p = 0.756, I^2 = 42% and SMD: -0.225, CI: -0.576 to 0.126, p = 0.209, I^2 = 0%, respectively), or for the left and right temporal muscles (SMD: -0.093, CI: -0.729 to 0.542, p = 0.773, I^2 = 68% and SMD: -0.016, CI: -0.973 to 0.941, p = 0.974, I^2 = 85%, respectively), with use of soft occlusal appliances. There was also no difference observed overall for the analysis that included soft occlusal appliances (SMD: -0.148, CI: -0.395 to 0.099, p = 0.241, I^2 = 43%) (Figure 5). The certainty of evidence was low (Table 7).

Meta-analysis of MBF

A meta-analysis was performed which included four studies[2, 8, 26, 27] (Figures 6 and 7). No significant difference in MBF was observed before and after use of hard occlusal appliances (SMD: -0.08, CI: -1.308 to 1.147, p = 0.898, I^2 = 81%) (Figure 6) or soft occlusal

appliances (SMD: -16.016, CI: -47.226 to 15.195, p = 0.315, I^2 = 97%) (Figure 7). The certainty of evidence was very low (Table 7).

Discussion

This systematic review analyzed the influence of occlusal appliances on masticatory function parameters of individuals diagnosed with SB. It was observed that occlusal appliances do not influence MP, MBF, MA, or muscle volume of such individuals. In addition, MBF and MA were also not affected by soft or hard appliances based on comparisons made before and after treatment of SB. However, occlusal appliances mediate a positive effect on reducing MTF.

MP can be influenced by the number of teeth in occlusion[25] and by the activation of the masticatory muscles, since the isometric and isotonic contractions of these muscles are essential for crushing and swallowing food.[30] Meanwhile, sleep bruxers present alterations in the masticatory muscles activity, which may result in myofascial pain[31] and MP impairment, especially in patients with severe SB.[30] However, the effect of occlusal appliances on masticatory muscles appears to be transiently accentuated when soft occlusal appliances are used,[18] or not significantly altered when hard occlusal appliances are used.[19] Therefore, MP was not affected by use of occlusal appliances, considering that the appliances have no proven effect on the activation of masticatory muscles.

Regarding MBF, a statistically significant difference was not detected before versus after treatment of SB with occlusal appliances. Since selected patients presented TMD associated with SB, TMD acts as a confounding factor for analysis of MBF in patients experiencing SB. Previous studies have demonstrated that MBF tends to decrease for individuals with SB who have undergone occlusal appliance therapy.[8, 26] However, an opposite effect has been observed in patients with TMD associated with SB.[27, 32] The latter observation is consistent with an increase in MBF in these patients due to improvements in

self-perception of pain/orofacial fatigue upon awakening and decreased signs and symptoms of TMD.[27, 33] Furthermore, the occlusal appliances do not prevent episodes of SB in patients with signs and symptoms of TMD,[34, 35] and maintenance of frequent and intense bruxism episodes may result in masticatory muscle hypertrophy in these patients. Therefore, improvement of signs and symptoms of TMD, as well as muscle hypertrophy, allows a patient to exert greater bite force without feeling pain.[27]

MA also did not statistically differ before and after treatment with occlusal appliances. In a recent study,[36] MA was found to be induced via activation, and consequent plasticity, of the brainstem in the central nervous system, even when sensory feedback from peripheral receptors was absent.[37, 38] Thus, muscle spindles and periodontal afferents are affected by occlusal appliances in mandibular repositioning and are not directly responsible for activity of the masticatory muscles.[12, 19]

Despite the use of different methods to assess muscle volume (e.g., magnetic resonance,[28] ultrasound[16]), it was not changed up to four months after occlusal devices were inserted.[28] Since the effectiveness in muscle relaxation by the use of occlusal appliances has not been proven,[39] the appliances do not reduce the intensity and frequency of SB episodes in the long term.[5] Therefore, muscle volume is maintained even after the use of hard occlusal appliances.

Unlike the other masticatory parameters, MTF was found to decrease with use of occlusal devices.[29, 40] The tongue is a muscular organ that can press on teeth during bruxism episodes.[40] If pressing is repeated with each nightly episode, a type of resistance muscle training develops which allows tongue force to progressively increase.[40] Conversely, occlusal appliances with palatal coverage can change the position of the tongue and its force in patients with SB, thereby promoting a reduction in MA.[41] This potentially significant

influence on tongue force can subsequently result in decreased incidence of lesions on the tongue, a relevant sign of SB.[29]

It is important to point out the relationship between masticatory muscle pain and SB, which is still uncertain in the literature[42] and is directly associated to MA. According to the pain-adaptation model proposed by Lund et al (1991),[43] nociceptive afferent input converges on group II interneurons in the spinal cord and brain stem resulting in reduced muscle force, and decreased amplitude, velocity, and displacement of the painful part to prevent further pain/injury.[43] Thus, sleep bruxers who show no painful symptoms have higher EMG activity than those with painful symptoms.[44, 45, 46] Therefore, since occlusal appliances are effective in reducing orofacial pain,[27, 47, 48] the EMG activity of masticatory muscles in sleep bruxers tends to continue altered. However, the masticatory function is not influenced only by MA, considering that mastication is a complex mechanism that requires the coordination of various chewing muscles, jaw kinematics and balance between the structures of the stomatognathic system.[20]

The RCTs that were assessed were identified as having low risk of bias. In contrast, most of the N-RCTs presented some concerns that bias may have affected the results of these studies. For example, the before and after N-RCTs were classified as having moderate[2, 8, 27, 28] or serious risk of bias.[14, 25, 26, 29] This increased risk of bias is mainly due to a lack of description of confounding factors regarding treatment effectiveness on masticatory function among the cohorts examined. A limitation of this review may be related to the heterogeneity of the included studies since different methodologies were used to evaluate the variables examined. The selected studies exhibited a lack of standardization in their evaluations of masticatory function, inclusion criteria, and periods of evaluation, thereby negatively affecting quantitative analyses and resulting in meta-analyses of only two variables (MA,

MBF). Furthermore, the latter were characterized by a limited number of included studies and a low level of certainty of evidence.

Future studies need to include randomized, controlled clinical trials that employ a standardized methodology for assessing masticatory function parameters and three types of occlusal appliances. Individuals exhibiting SB that are diagnosed by polysomnography and without signs of TMD should also be included to obtain more reliable and comparable findings, and to allow stronger conclusions to be made.

Conclusion

Based on the findings of this systematic review, use of occlusal appliances does not influence positively the masticatory function of dentate individuals affected by SB. However, the present results should be interpreted carefully due to the low and very low certainty of evidence.

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Table 1. Keywords used for database searches conducted on December 13, 2021.

Database	Search strategy
PubMed	("sleep bruxism"[MeSH Terms] OR "bruxism"[MeSH Terms] OR "bruxism*"[Title/Abstract] OR "teeth grinding"[Title/Abstract])AND ("occlusal splints"[MeSH Terms] OR "occlusal splint"[Title/Abstract] OR "occlusal appliance*"[Title/Abstract] OR "occlusal appliance"[Title/Abstract] OR "interocclusal appliance"[Title/Abstract] OR "interocclusal appliance*"[Title/Abstract] OR ("mandibular*"[Title/Abstract] AND "device*"[Title/Abstract]) OR ("maxilar*"[Title/Abstract] AND "device*"[Title/Abstract]) OR ("mandibular*"[Title/Abstract] AND "appliance"[Title/Abstract]) OR ("maxilar*"[Title/Abstract] AND "appliance"[Title/Abstract]))
Cochrane Library	#1: MeSH descriptor: [Sleep Bruxism]; #2: MeSH descriptor: [Bruxism]; #3: Teeth grinding:ti,ab,kw #1 OR #2 = #4 #3 OR #4 = #5 #6: MeSH descriptor: [Occlusal Splints]; #7: Occlusal Splint OR Occlusal appliance* OR occlusal appliance OR interocclusal appliance OR interocclusal appliance*) OR (Mandibular* AND Device*) OR (maxillar* AND device*) OR (mandibular* AND appliance) OR (maxillar* AND appliance):ti,ab,kw #6 OR #7 = #8 #5 AND #8 = #9
Embase	'sleep bruxism'/mj OR 'bruxism'/mj OR bruxism*:ti,ab,kw OR 'teeth grinding':ti,ab,kw AND 'Occlusal Splints'/mj OR ‘Occlusal Splint’:ti,ab,kw OR Occlusal appliance*:ti,ab,kw OR ‘occlusal appliance’:ti,ab,kw OR ‘interocclusal appliance’:ti,ab,kw OR interocclusal appliance*:ti,ab,kw OR (Mandibular*:ti,ab,kw AND Device*:ti,ab,kw) OR (maxillar*:ti,ab,kw AND device*:ti,ab,kw) OR (mandibular*:ti,ab,kw AND appliance:ti,ab,kw) OR (maxillar*:ti,ab,kw AND appliance:ti,ab,kw)

LILACS	((mh:(Sleep bruxism)) OR (mh:(Bruxism)) OR (bruxism* OR Teeth Grinding)) AND ((mh:(Occlusal Splints)) OR (Occlusal Splint OR Occlusal appliance* OR occlusal appliance OR interocclusal appliance OR interocclusal appliance*) OR (Mandibular* AND Device*) OR (maxillar* AND device*) OR (mandibular* AND appliance) OR (maxillar* AND appliance))
Scopus	(TITLE-ABS-KEY (“Sleep Bruxism” OR "Bruxism" OR "Teeth Grinding”) AND TITLE-ABS-KEY ("Occlusal Splints" OR "Occlusal Splint" OR Occlusal appliance* OR occlusal appliance OR interocclusal appliance OR interocclusal appliance* OR (Mandibular*AND Device*) OR (maxillar* AND device*) OR (mandibular* AND appliance) OR (maxillar* AND appliance))
Web of Science	TS= ("Sleep bruxism" OR "Bruxism" OR "Teeth Grinding" AND ("Occlusal Splints" OR "Occlusal Splint" OR "Occlusal appliance*" OR "occlusal appliance" OR "interocclusal appliance" OR "interocclusal appliance*" OR "Mandibular* AND Device*" OR "maxillar* AND device*" OR "mandibular* AND appliance" OR "maxillar* AND appliance")

LILACS: Latin American and Caribbean Health Sciences Literature database.

Table 2. Excluded articles and reasons for exclusion (n = 5).

Excluded Articles	
Author	**Reason for exclusion**
Chandu et al., 2004	1
Franco et al., 2011	1
Kashiwagi et al., 2021	1
Mora et al., 2013	1
Nishigawa et al., 2001	2

1: Focused on temporomandibular disorders, not bruxism; 2: Assessed maximum bite force during the night.

Table 3. Characteristics of the included studies.

First author, year, [ref no.], (country)	Study Design	N (total) Gender (F/M) Age: Mean (SD)	Groups	Occlusal Appliances	Data collection time points
Akat et al., 2020 [15] (Turkey)	RCT	68 43 / 25 25.4 y	Group 1: Control Group 2: Hard occlusal splint Group 3: Soft occlusal splint Group 4: Semi-soft occlusal splint	Hard Soft Semi-soft	(T0) Baseline (T1) 1 mo
Alkan et al., 2008 [4] (Turkey)	N-RCT Parallel study	20 16 / 4 20.5 y	Group 1: SB with occlusal appliance Group 2: SB with amitriptyline HCl, 10 mg/day Group 3: Control	Hard	(T0) Baseline (T1) 1 mo (T2) 3 mos
Câmara-Souza et al., 2019 [29] (Brazil)	N-RCT Parallel study	30 17 / 13 30.5 (± 5.9) y	Group 1: SB with occlusal appliance Group 2: SB with palatal device without occlusal coverage	Hard and Palatal device without occlusal coverage	(T0) Baseline (T1) 1 mo (T2) 2 mos
Dalewski et al., 2015 [17] (Poland)	RCT	30 NR 26.63 y	Group 1: Occlusal splint Group 2: Modified NTI splint	Hard Modified NTI Splint	(T0) Baseline (T1) 1 mo

Gomes et al., 2014 [16] (Brazil)	RCT	59 49 / 10 28.05 (± 5.06) y	Group 1: Massage group Group 2: Conventional occlusal splint group Group 3: Massage + conventional occlusal splint group Group 4: Silicone occlusal splint group	Hard Soft (silicone)	(T0) Baseline (T1) 1 mo
Hamada et al., 1982 [13] (Japan)	N-RCT Before & After	27 NR 26 y	Group 1: Bruxism Group 2: Control	Hard	(T0) 3× before treatment (T1) 3× after treatment
Mainieri et al., 2008 [10] (Brazil)	N-RCT Before & After	18 NR 38.8 (± 10.2) y	Group 1: SB	Soft (MAD)	(T0) Baseline (T1) 1 mo
Mainieri et al., 2014 [26] (Brazil)	N-RCT Before & After	19 11 / 8 39.9 (± 12.98) y	Group 1: SB	Soft (MAD)	(T0) Baseline (T1) 3 mos
Roark et al., 2003 [14] (USA)	N-RCT Before & After	20 13 / 7 23.5 y	Group 1: Parafunctional tooth contact	Hard	(T0) Baseline (T1) 3× with and without occlusal splint
Rodrigues Garcia et al.,	N-RCT Parallel	32 NR	Group 1: SB treated with occlusal device	Hard	(T0) Baseline (T1) 7 d

2005 [25] (Brazil)	study	32 y	Group 2: Control		(T2) 15 d (T3) 1 mo (T4) 2 mos
Rosar et al., 2017 [27] (Brazil)	N-RCT Parallel study	43 34 / 9 22.1 (± 2.2) y	Group 1: SB Group 2: Control	Hard	(T0) Baseline (T1) 1 mo (T2) 2 mos
Tuna et al., 2018 [28] (Turkey)	N-RCT Before & After	16 8 / 8 24.63 (± 4.83) y	Group 1: Bruxism	Hard	(T0) Baseline (T1) 4 mos

Legend: SD – Standard deviation; N-RCT – Non-randomized clinical trial; RCT – Randomized clinical trial; NR – Not recorded; MAD – Mandibular advancement device; NTI – Nociceptive trigeminal inhibition; SB – Sleep bruxism; T – Time.

Table 4. Risk of bias assessment for the randomized clinical trials using the RoB-2 tool.

Domains	Signaling questions	Akat et al., 2020	Dalewski et al., 2015	Gomes et al., 2014
1. Bias arising from the randomization process	1.1	Y	Y	Y
	1.2	N	Y	Y
	1.3	N	PN	PN
	Judgment	Low risk	Low risk	Low risk
2. Bias due to deviations from intended interventions	2.1	PY	PY	PY
	2.2	Y	Y	Y
	2.3	PN	PN	NA
	2.4	NA	NA	NA
	2.5	NA	NA	NA
	2.6	PY	PY	PY
	2.7	NA	NA	NA
	Judgment	Low risk	Low risk	Low risk
3. Risk of bias due to missing outcome data	3.1	Y	Y	Y
	3.2	NA	NA	NA
	3.3	NA	NA	NA
	3.4	NA	NA	NA
	Judgment	Low risk	Low risk	Low risk
4. Risk of bias in measurement of outcomes	4.1	N	N	N
	4.2	N	PN	N

	4.3	N	N	PN
	4.4	NA	NA	NA
	4.5	NA	NA	NA
	Judgment	Low risk	Low risk	Low risk
5. Risk of bias in selection of reported results	5.1	N	N	N
	5.2	PN	PN	PN
	5.3	PN	PN	N
	5.4	NA	NA	NA
	Judgment	Low risk	Low risk	Low risk
Overall Risk of Bias		**Low risk**	**Low risk**	**Low risk**

Y – Yes; N – No; PN – Probably No ; PY – Probably Yes ; NA – not available.

Table 5. Risk of bias assessment for the non-randomized clinical trials using the ROBINS-I tool.

Domains	Signaling questions	Alkan et al., 2008	Câmara-Souza et al., 2019	Hamada et al., 1982	Mainieri et al., 2008	Mainieri et al., 2014	Roark et al., 2003	Rodrigues Garcia et al., 2005	Rosar et al., 2017	Tuna et al., 2017
1. Bias due to confounding	1.1	Y	Y	Y	N	N	N	Y	Y	N
	1.2	Y	Y	Y	NA	NA	NA	Y	Y	NA
	1.3	N	NI	N	NA	NA	NA	NI	N	NA
	1.4	PN	PN	N	NA	NA	NA	PN	Y	NA
	1.5	NA	NA	NA	NA	NA	NA	NA	Y	NA
	1.6	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1.7	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1.8	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Judgment	Moderate risk	Critical risk	Critical risk	Low risk	Low risk	Low risk	Critical risk	Moderate risk	Low risk
2. Bias in selection of participants into the study	2.1	N	N	N	N	N	N	N	N	N
	2.2	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2.4	Y	Y	N	Y	Y	Y	Y	Y	Y
	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Judgment	Low risk	Low risk	Moderate risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
3. Risk in	3.1	Y	Y	Y	Y	Y	Y	Y	Y	Y

classification of interventions	3.2	Y	Y	N	N	N	Y	Y	Y	N
	3.3	N	N	NI	NI	N	N	Y	PN	NI
	Judgment	Low risk	Low risk	Moderate risk	Moderate risk	Moderate risk	Low risk	Moderate risk	Low risk	Moderate risk
4. Bias due to deviations from intended interventions	4.1	N	N	N	N	N	N	N	N	N
	4.2	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4.4	Y	Y	Y	Y	Y	Y	Y	Y	Y
	4.5	Y	Y	Y	Y	Y	Y	Y	Y	Y
	4.6	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Judgment	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
5. Bias due to missing data	5.1	Y	Y	Y	Y	N	Y	Y	Y	Y
	5.2	N	N	N	N	Y	N	N	N	PY
	5.3	N	N	N	N	Y	N	N	N	PY
	5.4	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5.5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Judgment	Low risk	Low risk	Low risk	Low risk	Critical risk	Low risk	Low risk	Low risk	Moderate risk
6. Bias in measurement of outcomes	6.1	N	N	N	N	N	N	N	N	N
	6.2	Y	Y	Y	Y	Y	Y	Y	Y	Y
	6.3	Y	Y	Y	Y	Y	NA	Y	Y	NA

	6.4	N	N	N	N	N	N	N	N	NI
	Judgment	Moderate risk	Moderate risk	Moderate risk	Moderate risk	Moderate risk	Moderate risk	Moderate risk	Moderate risk	Moderate risk
7. Bias in selection of reported results	7.1	N	N	N	N	N	N	N	N	N
	7.2	N	N	N	N	N	N	N	N	N
	7.3	N	N	N	N	N	N	N	N	N
	Judgment	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Overall Risk of Bias		**Moderate risk**	**Serious risk**	**Serious risk**	**Moderate risk**	**Serious risk**	**Low risk**	**Serious risk**	**Moderate risk**	**Moderate risk**

Y – Yes; N – No; NI – Not informed; PN – Probably No; PY – Probably Yes; NA – Not applicable.

Table 6. Outcomes of the included studies.

First author, Year [Ref no.]	Types of Occlusal Appliances and Variables	*P*-value	Main conclusions
	Hard		
Alkan et al., 2008 [4]	MBF (N), Mean (SD) G1: Baseline – 793.82 (352.16); 1 mo – 533.30 (288.31); 3 mos – 413.46 (99.64) G2: Baseline – 773.24 (194.44)	< 0.05	A prolonged follow-up study of a larger patient population is needed. It appears helpful to follow occlusal changes after treatment of bruxism with a Dental Prescale.
Rosar et al., 2017 [27]	MBF (N), Mean (SD) G1 Left: Baseline – 496.8 (129.1); 1 mo – 546.5 (138.7); 2 mos – 588.9 (126.2) G2 Left: Baseline – 452.4 (50.2); 1 mo – 465.3 (49.8); 2 mos – 459.6 (63.2) G1 Right: Baseline – 476.5 (140.6); 1 mo – 556.3 (149.8); 2 mos – 596.5 (162.1) G2 Right: Baseline – 471.5 (94.5); 1 mo – 470.0 (96.8); 2 mos – 475.5 (92.2)	0.0122 – Left 0.0003 – Right	The results suggest that short-term treatment with interocclusal appliance therapy had a positive effect on bite force in adults with SB.
Rodrigues Garcia et al., 2005 [25]	MP, Mean (SD) G1: Baseline 4 masticatory cycles – 781.70 (146.77); 1 week / 4 masticatory cycles – 786.11 (120.36); 15 d / 4 masticatory cycles – 795.85 (111.51); 1 mo / 4 masticatory cycles – 742.27 (127.96); 2 mos / 4 masticatory cycles – 748.12 (123.13); G1: Baseline 12 masticatory cycles – 1711.80 (344.44); ; 1 week 12 masticatory cycles – 1566.55 (328.38); 15 d / 12 masticatory cycles – 1681.75 (302.75);	> 0.05	Occlusal appliance therapy did not alter masticatory performance in subjects with mild bruxism.

	1 mo / 12 masticatory cycles – 1797.67 (360.96); 2 mos / 12 masticatory cycles – 1698.70 (361.23) G2: Baseline 4 cycles – 848.06 (494.41); Baseline 12 cycles – 1793.56 (321.14)		
Hamada et al., 1982 [13]	MA, Mean (SD) G1:Preferred chewing side - Masseter: Baseline – 0.054; After – 0.037; Temporal: Baseline – 0.035; After – 0.023; G1: Non-Preferred chewing side - Masseter: Baseline – 0.059; After – 0.040; Temporal: Baseline – 0.035; After – 0.024 G2: Preferred chewing side - Masseter: Baseline – 0.035; Temporal: Baseline – 0.022 G2: Non-Preferred chewing side Masseter: Baseline – 0.044; Temporal: Baseline – 0.024	NR	Splint therapy plays an important role in reducing hyperactivity of the masticatory muscles and leads to a resting condition for them.
Roark et al., 2003 [14]	MA, Mean (SD) Right masseter - (Minimal contact): Without Splint – 3.44 (1.98); With Splint – 4.23 (3.66); (Moderate clenching): Without Splint – 10.18 (7.45); With Splint – 16.13 (12.95); (Maximal clenching): Without Splint – 67.85 (33.78); With Splint – 60.88 (33.75) Left masseter - (Minimal contact): Without Splint – 3.61 (2.31); With Splint 4.15 (5.32); (Moderate clenching): Without Splint – 9.74 (5.94); With Splint – 17.48 (12.83); (Maximal clenching): Without Splint – 68.72 (32.64); With Splint – 68.06 (48.90) Right temporal - (Minimal contact): Without Splint –	> 0.05 – Masseter < 0.05 – Temporal	The effectiveness of interocclusal appliances may be due to mechanisms other than redistribution of adverse loading.

	6.21 (4.34); With Splint – 4.29 (3.52); (Moderate clenching): Without Splint – 23.02 (16.44); With Splint – 14.30 (11.05); (Maximal clenching): Without Splint – 90.69 (33.97); With Splint – 60.22 (31.37) Left temporal - (Minimal contact): Without Splint – 5.18 (3.19); With Splint – 3.96 (2.77); (Moderate clenching): Without Splint – 19.12 (14.93); With Splint – 13.67 (10.47); (Maximal clenching): Without Splint – 80.85 (35.64); With Splint – 54.10 (26.41)		
Tuna et al., 2018 [28]	Muscle Volume (cm^3), Mean (SD) Right Masseter: Baseline – 22.42 (6.61); 4 mos – 22.02 (6.51) Left Masseter: Baseline – 22.65 (5.59); 4 mos – 22.47 (5.81)	> 0.05	Use of a stabilization splint for four months did not change the volume of the masseter muscle.
	Hard and Modified NTI Splint		
Dalewski et al., 2015 [17]	MA, Mean (SD) Right Masseter: Baseline – 2.14 (1.67%); 1 mo – 1.99 (1.35%) Left Masseter: Baseline – 2.87 (2.81%); 1 mo – 2.32 (3.14%) Right Temporal Anterior: Baseline – 4.96 (5.46%); 1 mo – 4.3 (3.85%) Left Temporal Anterior: Baseline – 8.37 (11.42%); 1 mo – 6.33 (4.99%)	> 0.05	The occlusal splint showed no sustainable influence on the examined muscles after 1 month of typical bruxism treatment.
	Hard and Palatal device without occlusal coverage		

Câmara-Souza et al., 2019 [29]	MTF (N), Mean (SD) Total: Baseline – 9.11 (4.05); 1 mo – 6.23 (2.63); 2 mos – 4.94 (1.54) Anterior: Baseline – 5.89 (2.23); 1 mo – 3.61 (1.56); 2 mos – 3.21 (1.22) Posterior: Baseline – 3.42 (2.60); 1 mo – 2.62 (1.76); 2 mos – 1.73 (0.58)	< 0.05	Intraoral devices reduced maximum tongue force.
	Soft (MAD)		
Mainieri et al., 2008 [10]	MBF (N), Mean (SD) Single Group: Baseline – 794.7 (381.9); 1 mo – 614.4 (298.9)	0.018	Use of a soft mandibular advancement device for 30 d reduced bite force.
Mainieri et al., 2014 [26]	MBF (N), Mean (SD) Single Group: Baseline – 828.55 (0.09); 3 mos – 538.59 (0.09)	< 0.001	Use of MAD in patients with SB produced a very significant reduction in maximum occlusal force.
	Hard and Soft		
Gomes et al., 2014 [16]	MA, Mean (SD) Group 2 – Right Temporal: Baseline – 188.7 (169.9-213.6); 1 mo – 195.8 (182.9-210.1); Right Masseter: Baseline – 151.6 (116.9-168.9); 1 mo – 160.4 (135.7-183.8); Left Temporal: Baseline – 194.8 (158.9-206.8); 1 mo – 193.4 (158.4-206.3); Left Masseter: Baseline – 145.8 (120.8-169.4); 1 mo – 154.3 (122.3-179.7) Group 4 – Right Temporal: Baseline – 159.7 (157.7-173.6); 1 mo – 168.7 (156.5-180.2); Right Masseter: Baseline – 156.5 (130.6-177.5); 1 mo – 148.7 (121.3-167.5); Left Temporal: Baseline – 156.7 (122.1-188.2); 1	NR	Massage therapy and use of an occlusal splint did not lead to statistically significant changes in electromyographic activity in the masseter and anterior temporal muscles. However, the combination of therapies did result in a reduction in the intensity of signs and signs among individuals with severe TMD and SB.

	mo – 170.4 (145.5-208.7); Left Masseter: Baseline – 135.0 (117.4-158.0); 1 mo – 143.8 (90.09-155.8)		
	Hard, Soft and Semi-soft		
	MA, Mean (SD) Group 1 – Right masseter in clenching: Baseline – 33.4 (12.4); 1 mo – 33.0 (11.5); Left masseter in clenching: Baseline – 33.4 (12.3); 1 mo – 34.25 (12.65); Right temporal in clenching: Baseline – 33.6 (13.3); 1 mo – 34.4 (13.7); Left temporal in clenching: Baseline – 34.5 (12.3); 1 mo – 34.1 (12.2) Group 2 – Right masseter in clenching: Baseline – 58.8 (19.6); 1 mo – 43.0 (14.4); Left masseter in clenching: Baseline – 67.8 (21.3); 1 mo – 49.54 (19.18); Right temporal in clenching: Baseline – 51.1 (22.9); 1 mo – 44.2 (20.0); Left Temporal in clenching: Baseline – 58.2 (28.6); 1 mo – 47.2 (18.7); Group 3 – Right masseter in clenching: Baseline –52.6 (23.3); 1 mo – 46.9 (20.1); Left masseter in clenching: Baseline – 50.5 (21.4); 1 mo – 44.21 (19.93); Right temporal in clenching: Baseline – 60.2 (23.6); 1 mo – 49.6 (17.4); Left temporal in clenching: Baseline – 58.2 (22.5); 1 mo – 49.5 (19.1) Group 4 – Right masseter in clenching: Baseline – 57.8 (22.5); 1 mo – 52.0 (19.1); Left masseter in clenching: Baseline – 56.0 (26.4); 1 mo – 47.39 (19.43); Right	NR	A post-treatment decrease in EMG activity was observed in all three occlusal splint groups, and it was most prominent in the hard occlusal splint group. Thickness of the muscles used in mastication may decrease after bruxism treatment. Ultrasonographic muscle length and thickness measurements should also be used to determine muscle activity and EMG patterns in bruxism patients.

	temporal in clenching: Baseline – 52.4 (18.2); 1 mo – 46.9 (12.4); Left Temporal in clenching: Baseline – 55.2 (21.4); 1 mo – 47.5 (15.0);	
Akat et al., 2020 [15]	Muscle Length and Thickness (mm), Mean (SD) Group 2 – Right Masseter Length: Baseline – 60.7 (8.0); 1 Mo – 60.9 (8.0); Right Masseter Thickness: Baseline – 39.2 (9.0); 1 Mo – 39.1 (9.0); Left Masseter Length: Baseline – 61.0 (7.9); 1 Mo – 61.5 (7.9); Left Masseter Thickness: Baseline – 39.8 (9.5); 1 Mo – 39.5 (9.5); Right Temporal Thickness: Baseline – 11.3 (1.6); 1 Mo – 11.5 (1.5); Left Temporal Thickness: Baseline – 10.9 (1.4); 1 Mo – 11.2 (1.4) Group 3 – Right Masseter Length: Baseline – 58.5 (5.7); 1 Mo – 58.5 (5.7); Right Masseter Thickness: Baseline – 42.7 (5.0); 1 Mo – 42.8 (5.0); Left Masseter Length: Baseline – 58.7 (5.4); 1 Mo – 58.8 (5.4); Left Masseter Thickness: Baseline – 43.1 (4.9); 1 Mo – 43.0 (4.9); Right Temporal Thickness: Baseline – 11.0 (1.2); 1 Mo – 11.0 (1.2); Left Temporal Thickness: Baseline – 11.2 (1.4); 1 Mo – 11.3 (1.5) Group 4 – Right Masseter Length: Baseline – 61.4 (9.0); 1 Mo – 61.5 (9.0); Right Masseter Thickness: Baseline – 45.6 (8.3); 1 Mo – 45.6 (8.2); Left Masseter Length: Baseline – 61.2 (8.8); 1 Mo – 61.3 (8.9); Left Masseter Thickness: Baseline – 46.0 (8.1); 1 Mo – 45.8 (8.1); Right Temporal Thickness: Baseline – 10.7 (1.1); 1 Mo –	NR

	10.9 (1.2); Left Temporal Thickness: Baseline – 10.8 (1.8); 1 Mo – 10.9 (1.8)

Table 7. Certainty of evidence.

Certainty assessment						No. muscles		Effect	Certainty
No. studies / Study design	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Before**	**After**	**SMD (95% CI)**	
Muscle activity (masseter and temporal) for hard occlusal appliances									
2 Clinical trials	Not serious	Very serious[a,b]	Not serious	Serious[c]	None	128	128	-0.199 (-0.489 to 0.091)	⊕◯◯◯ Very low
Muscle activity (masseter and temporal) for soft occlusal appliances									
2 Clinical trials	Not serious	Serious[b]	Not serious	Serious[c]	None	128	128	-0.148 (-0.395 to 0.099)	⊕⊕◯◯ Low
Maximum bite force for hard occlusal appliances									
2 Clinical trials	Serious[d]	Very serious[b,e]	Not serious	Very serious[c,f]	None	37	37	-0.08 (-1.308 to 1.147)	⊕◯◯◯ Very low
Maximum bite force for soft occlusal appliances									

Certainty assessment						No. muscles		Effect	Certainty
No. studies / Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Before	After	SMD (95% CI)	
2 Clinical trials	Serious[d]	Very serious[b,e]	Serious[g]	Very serious[c,f]	None	33	33	-16.016 (-47.226 to 15.195)	⊕◯◯◯ Very low

SMD: Standard mean difference; CI: confidence interval.

a. Substantial heterogeneity.

b. Some variation in the effect estimates across studies with little overlap of confidence intervals associated with the effect estimates.

c. Total number of participants < 400.

d. All included studies presented a risk of bias.

e. Considerable heterogeneity.

f. Upper or lower confidence limit crosses the effect size of 0.5 in either direction.

g. Results could not be extrapolated to patients with TMJ

Table 8. Certainty of evidence of qualitative outcomes.

Certainty assessment						No. of patients	Certainty
No, studies Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations		
Masticatory performance							
1 Clinical trial	Very serious[a]	Not serious	Very serious[b,c]	Serious[d]	None	32	⊕◯◯◯ Very low
Maximum tongue force							
1 Clinical trial	Very serious[a]	Not serious	Very serious[b,c]	Serious[d]	None	30	⊕◯◯◯ Very low
Muscle volume							
2 Clinical trials	Serious[e]	Serious[f]	Serious[b]	Serious[d]	None	84	⊕◯◯◯ Very low

a. Included study was classified as serious risk of bias.

b. Results could not be extrapolated to patients with TMD.

c. Results could not be extrapolated to soft occlusal splint.

d. Total number of participants < 400.

e. One of two included studies which were classified as moderate risk of bias.

f. Included studies showed different effects.

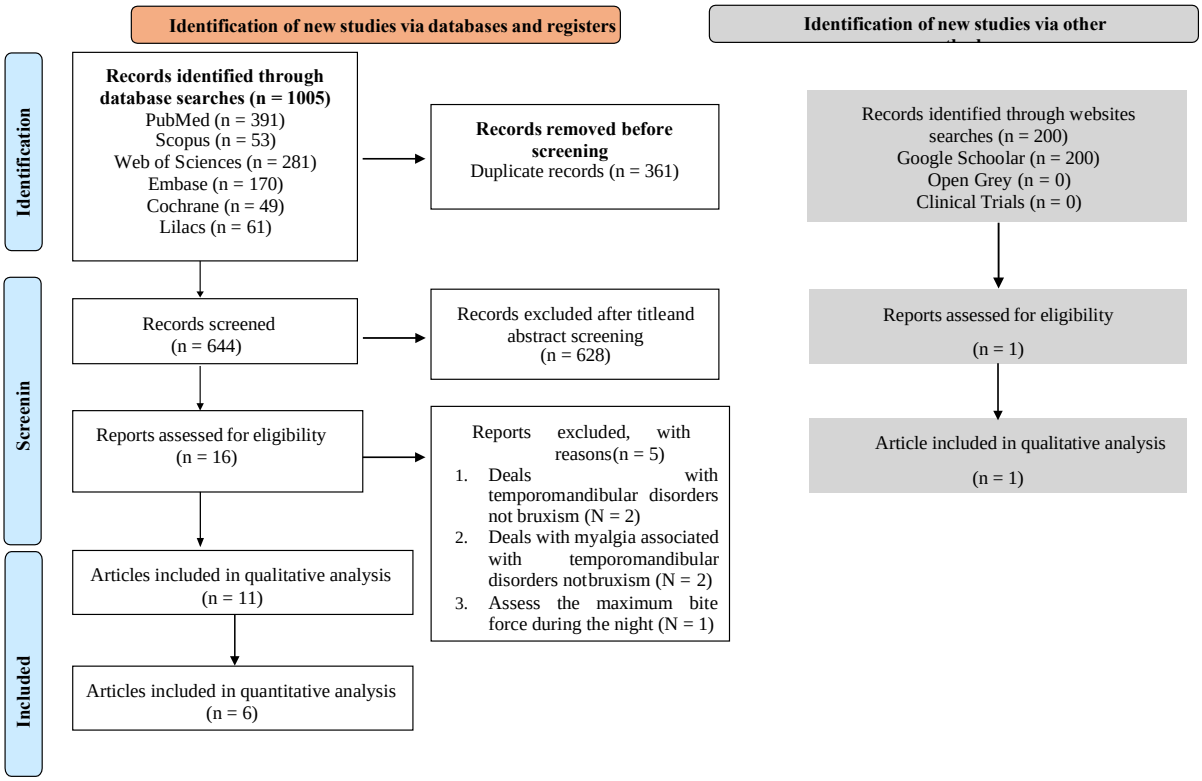

Figure 1. Flow diagram of study selection process.

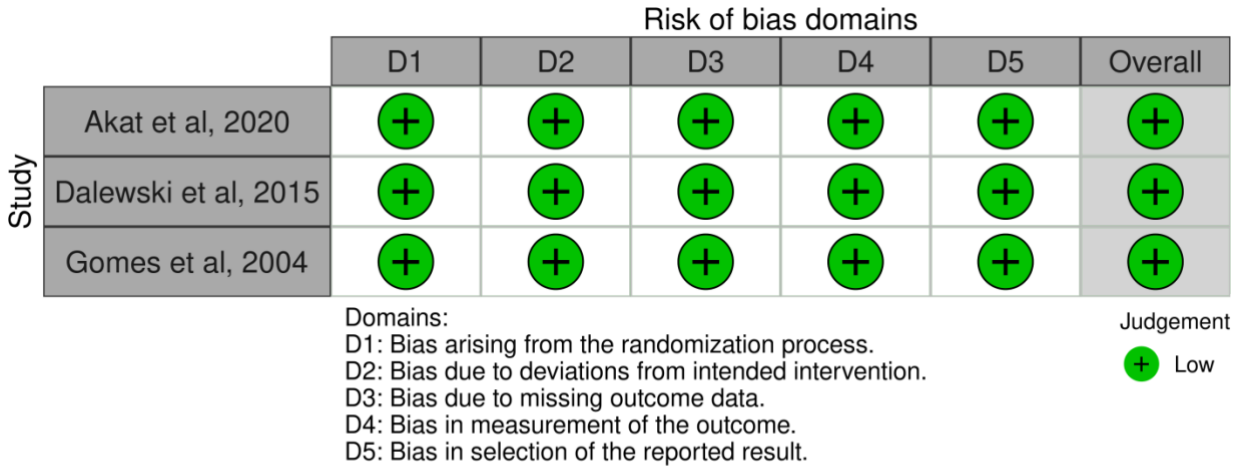

Figure 2. Risk of bias assessment for the randomized clinical trials according to RoB-2 tool.

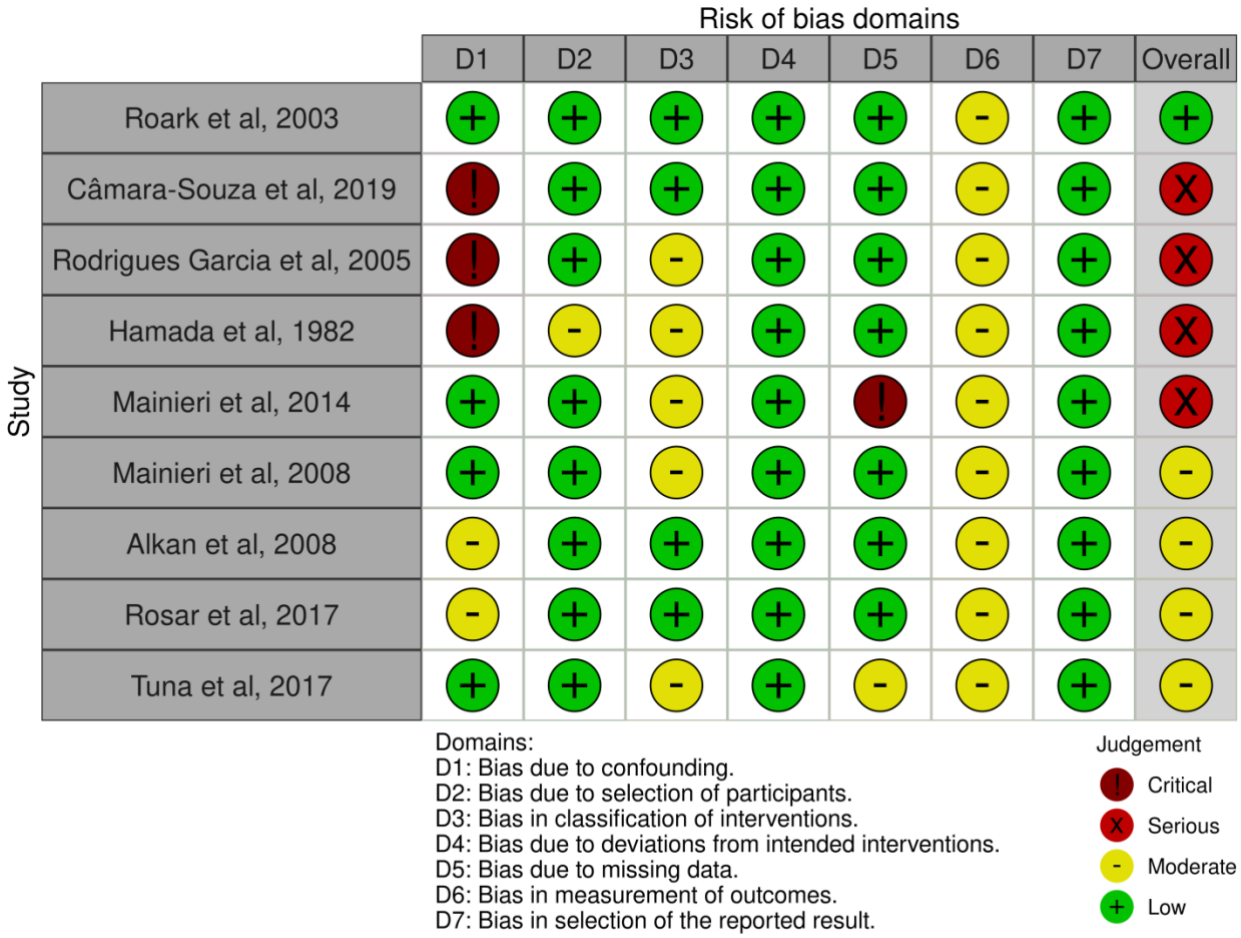

Figure 3. Risk of bias assessment for the non-randomized clinical trials according to the ROBINS-I tool.

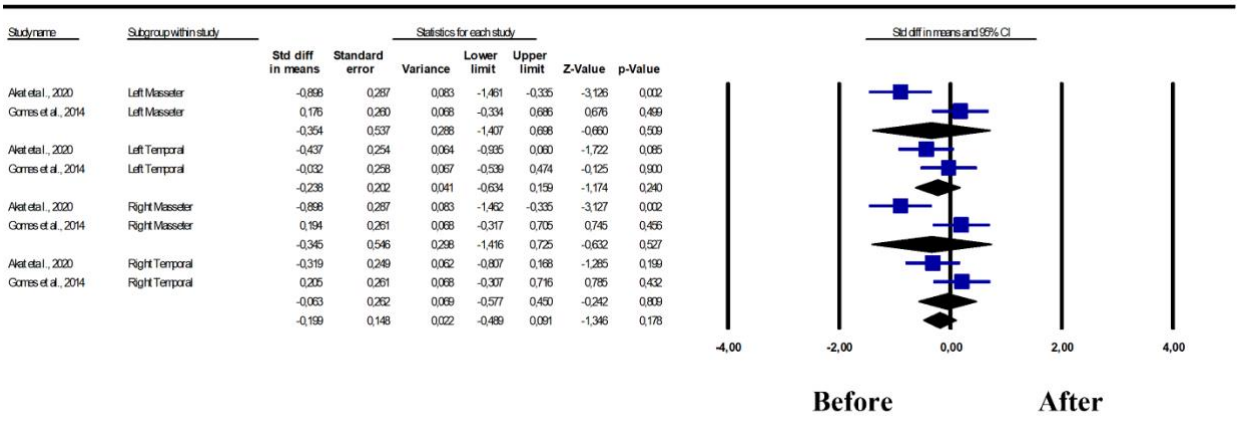

Figure 4. Meta-analysis of MA (masseter and temporal) before and after 30 d of hard occlusal appliance use.

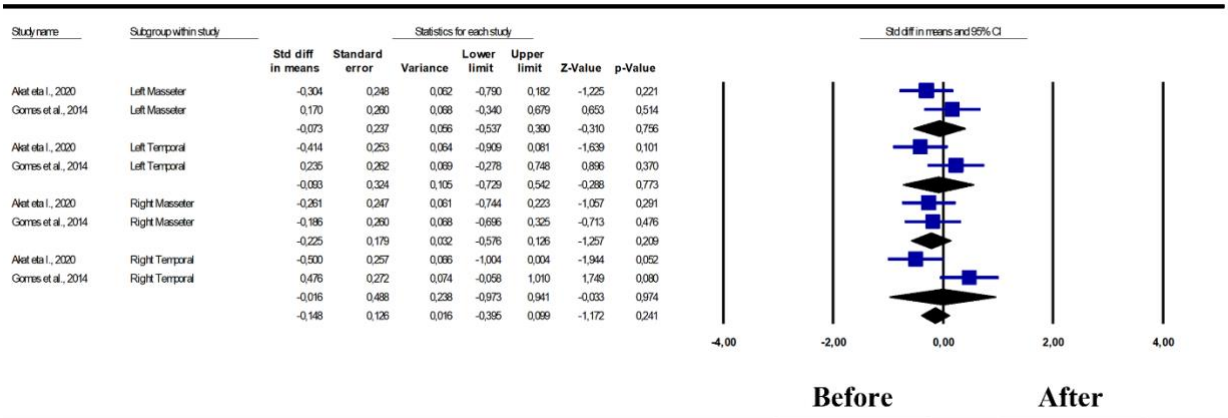

Figure 5. Meta-analysis of MA (masseter and temporal) before and after 30 d of soft occlusal appliance use.

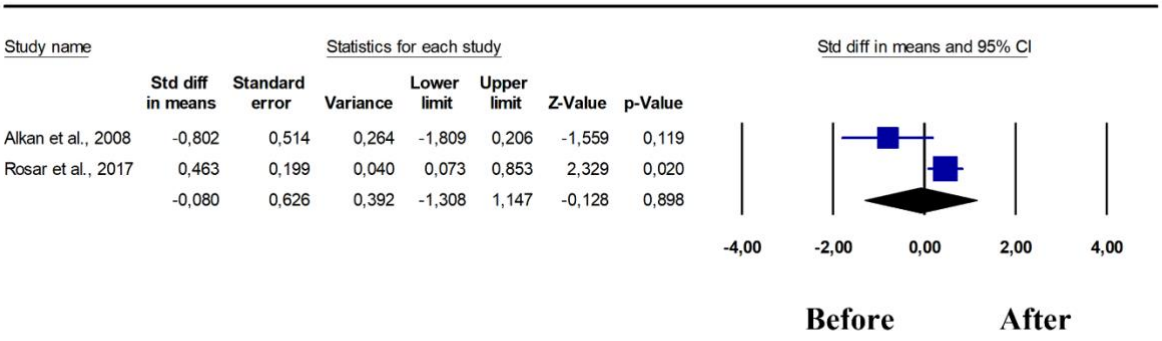

Figure 6. Meta-analysis of MBF (N) before and after 30 d of hard occlusal appliance use.

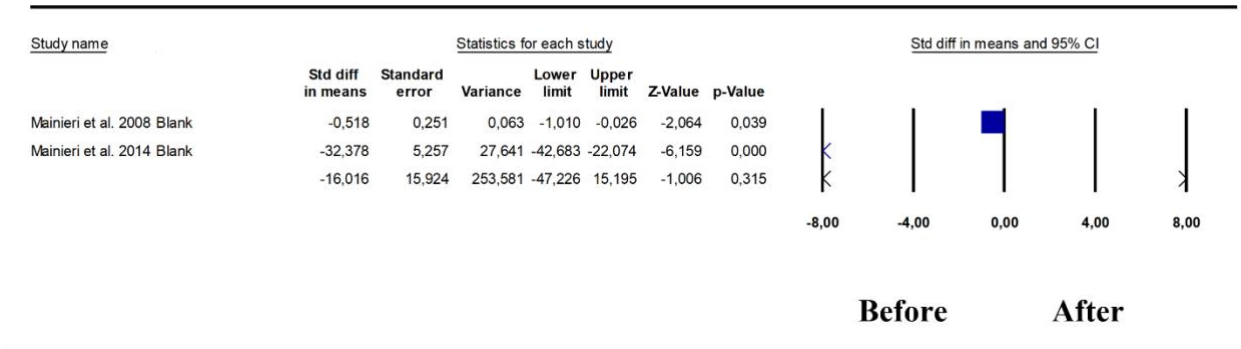

Figure 7. Meta-analysis of MBF (N) before and after 30 d of soft occlusal appliance use.

Figure Captions

Figure 1. Flow diagram of study selection process.

Figure 2. Risk of bias assessment of randomized clinical trials, according to RoB-2 tool.

Figure 3. Risk of bias assessment for non-randomized clinical trials, according to ROBINS-I tool.

Figure 4. Meta-analysis of muscle activity (masseter and temporal) before and after 30 days of using hard occlusal appliances.

Figure 5. Meta-analysis of muscle activity (masseter and temporal) before and after 30 days of using soft occlusal appliances.

Figure 6. Meta-analysis of maximum bite force (Newton) before and after 30 days of using hard occlusal appliances.

Figure 7. Meta-analysis of maximum bite force (Newton) before and after 30 days of using soft occlusal appliances.

3 CONCLUSÃO

Com base nos achados desta revisão sistemática com meta-análise, conclui-se que os aparelhos oclusais não influenciam a função mastigatória em termos de atividade e volume muscular, força máxima de mordida e performance mastigatória em indivíduos com BS. Entretanto, a força máxima de língua de indivíduos com BS reduz com o uso dos aparelhos oclusais.

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ANEXO 1. Verificação de originalidade e prevenção de plágio.

INFLUÊNCIA DE APARELHOS OCLUSAIS NA MASTIGAÇÃO DE INDIVÍDUOS COM BRUXISMO DO SONO

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3	Olívia Maria Costa de Figueredo, Lorena Tavares Gama, Mariana Barbosa Câmara-Souza, Guido Artemio Marañón-Vásquez et al. "Influence of different presentations of denture adhesives on masticatory function of complete denture wearers: A systematic review and meta-analysis", The Journal of Prosthetic Dentistry, 2021 Publicação	1%
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5	Bannai, Deepthi. "Retinal Cytoarchitectural Changes in Schizophrenia and Bipolar	1%

ANEXO 2. Comprovante de registro na plataforma International Prospective Register of Systematic Reviews (PROSPERO).

ID	Title	Status	Last edited
CRD42021276758	Effect of occlusal device on masticatory performance in patients with bruxism: A systematic review To enable PROSPERO to focus on COVID-19 registrations during the 2020 pandemic, this registration record was automatically published exactly as submitted. The PROSPERO team has not checked eligibility.	Registered	24/11/2021

ANEXO 3. Protocolo de submissão do manuscrito no periódico *The Journal of Craniomandibular & Sleep Practice (CRANIO).*

Dear Dr. Rodrigues Garcia

We acknowledge receipt of your submission entitled "Influence of occlusal appliances on chewing of individuals with sleep bruxism: A systematic review and meta-analyses." to CRANIO: The Journal of Craniomandibular & Sleep Practice.

You will be able to check the progress of your paper by logging on to Editorial Manager as an author at the URL
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